

SCIENCE.

FRIDAY, FEBRUARY 11, 1887.

COMMENT AND CRITICISM.

THE AUTHORITIES of the Johns Hopkins university have always held, and rightly, that the true university must not only afford ample opportunities for original research in library and in laboratory, but that it must also afford opportunity for the publication of the results of such research. As a result of this policy, the publication of the *American journal of mathematics*, the *American chemical journal*, the *American journal of philology*, the *Studies from the biological laboratory*, and the *Studies in historical and political science*, has been successively and successfully undertaken. The announcement is now made that this formidable list is to be extended by the addition of an *American journal of psychology*, under the editorship of Prof. G. Stanley Hall. The journal is to be published quarterly, and the first number will appear at an early date. The scope of the journal is to be as wide as that of psychology itself, though we infer from the announcement, that the major portion of the space will be devoted to the results of investigation in psycho-physics, psychogenesis, and to the physiological side of mental science in general. It is purposed also to reproduce entire valuable articles from other journals, when they are not readily accessible in their original form. The journal will, it seems to us, find a field awaiting it; for the *Revue philosophique* and the *Philosophische monatshefte*, together with their continental contemporaries, are hardly read in this country at all; and their columns seldom, if ever, print an article by an American scholar. *Mind*, to be sure, has been very generous of late in its allotment of space to American authors, but it has a very limited circulation in this country. To appeal, first of all, to American readers and students of mental science, and to embody the latest results of American research, should be the particular aims of the new journal.

IN CALIFORNIA, if anywhere, forestry should claim proper attention from the state; and, apparently on the principle of better late than never, the first biennial report of the State board of for-

estry is now issued. A region like middle and southern California, on the borderland between sufficient and insufficient rainfall, where irrigation is essential to agriculture, must care for its streams, and must therefore care for the forests where they rise. By this it is not intended to assert that forests exercise any control over the amount of rainfall, and it is a satisfaction to see that this popular fallacy receives no very direct support in the report under consideration: but as regulators of discharge by streams, the importance of the relation between forests and rainfall cannot be questioned; and in a state like California, where the forests are peculiarly limited to the higher, rough, non-arable lands, whence the streams flow down to the farms below, the preservation of a fair share of the trees is a prime necessity. In the southern part of the state the balance of conditions is so delicate, that the forests merely survive, but have no recuperative power. If destroyed, they do not spring up again, but leave the surface barren. It is in such districts that much damage has already been done, not only in defacing the hill country, but in increasing the irregularity of stream-flow. The rain runs off from a bare hillside in a violent flood, carrying soil and gravel with it, and leaving no store of moisture in the ground to supply springs in the dry season. The forestry board and the school of forestry, inaugurated at Los Angeles in the University of southern California, have therefore a large work before them, that must become of much value to the state.

IN THE *Nineteenth century* for January, Mr. George J. Romanes replies to the critics of his paper, read some time ago before the Linnaean society, on 'Physiological selection,—an additional suggestion on the origin of species.' He says that the first mistake his critics made, was in treating his idea as a fully elaborated theory, instead of, as was intended by Mr. Romanes, a mere suggestion or working hypothesis. He quietly adds that the study of his critics' arguments only makes him think more highly of his suggestion. Mr. Romanes' hypothesis of physiological selection sets out with an attempt to prove, that, con-

sidered as a theory of the origin of species, the theory of natural selection is inadequate. The evidence going to make up this proof falls under three heads: first, the inutility to species of a larger proportional number of their specific characters; second, the general fact of sterility between allied species, which it is admitted cannot be explained by natural selection, and therefore has hitherto never been explained; and, third, the swamping influence, even upon useful variations, of free intercrossing with the parent form. Because of these facts, Mr. Romanes asserts that the theory of natural selection is not a theory of the origin of species at all, but a theory of the cumulative development of adaptations. Physiological selection or 'segregation of the fit,' on the other hand, Mr. Romanes brings forward as a theory of the origin of species. After briefly explaining what is meant by physiological selection, — which he does in a way too compact to be abridged, and too long to be quoted, — Mr. Romanes turns to his critics, and deals with the objections which they have advanced. Two of them — Messrs. A. R. Wallace and Seebohm — are referred to by name, and Mr. Romanes' criticism of them is very interesting reading. He ascribes the objections of both of these gentlemen to a misunderstanding of what physiological selection really means, and deals with the whole subject in so comprehensive and yet detailed a way, that we may be sure a reply will be provoked from such of the critics as deem themselves misrepresented or unfairly used in the present article.

THE CURRENT WORK of the U. S. fish commission at its various stations shows gratifying results in hatching young fish. At Washington, 5,000,000 white-fish eggs are now being hatched, the fry to be sent to Lake Erie. Small lots of *Salmonidae* are also being hatched there, principally for the purpose of illustrating the different methods of fish-culture. At Northville and Alpena, Mich., 125,000,000 white-fish eggs were collected during the fall, of which 25,000,000 have been distributed to the state commissioners, for hatching and planting, and about 100,000,000 have been reserved to be hatched at the Northville station, the fry to be placed in the ocean and the great lakes. The station at Wood's Holl has been actively engaged in collecting, hatching, and distributing the eggs of cod-fish, of which 26,000,000 have been hatched and planted in Vineyard Sound and other

adjacent waters. It is probable the total production of the season will exceed 100,000,000 cod-fish when eggs are obtained from the Ipswich-Bay school. At Wytheville, Va., the collecting of California trout eggs is now in full progress, over 100,000 eggs having been obtained, of which fifty per cent will be distributed in lots of 5,000 and 10,000 to the different state commissions, the balance to be hatched and reared at the station, and distributed as yearling fish to the streams of the Appalachian region in Pennsylvania, Virginia, West Virginia, North Carolina, Georgia, and Tennessee.

THE DEBATE in the senate on the appropriations for the support of the coast survey during the next fiscal year shows the appreciation by that body of the importance of making appropriations sufficient to carry on the service effectively. The house pared the items down in a parsimonious spirit, and with a false idea of economy, without consulting the coast survey officials, or the treasury department, or the needs of the service. The senate appropriations committee addressed a letter to the secretary of the treasury, inquiring if the estimates as submitted by the superintendent of the coast survey were satisfactory to that department. The secretary replied that the estimates as submitted were entirely satisfactory, and fully sustained the superintendent of the coast survey. He also submitted an interesting and instructive communication from Mr. Thorn, showing the reasons for each item of expenditure and the present condition of the service, which we have not room to print. The secretary closed his letter with the following observation: "From these communications it appears that the estimates made provision for the efficient and economical prosecution of the survey during the ensuing year; it also appears that the provision made by the house bill will not secure such results: consequently the arrangement there made is not satisfactory to this department."

THE EXPLANATION given by the investigators of the Plymouth epidemic of the origin of that epidemic has by some been regarded as unsatisfactory, because it required the acceptance of the theory that typhoid-fever germs could retain vitality after being exposed to the intense cold which prevails in that latitude during the winter. Dr. J. S. Billings, U.S.A., has been experimenting on this point, and gives the results of his experi-

ments to the *Sanitary engineer*. On Jan. 10, 1887, five cubic centimetres of sterilized water in a test-tube were inoculated with typhoid bacillus, and exposed to the outer air during the following night at a temperature of 10° F. It was found solidly frozen during the morning. Jan. 11, this frozen mass was thawed, and from it there were inoculated one agar and three gelatine tubes. On Jan. 13 there was a decided typical development of the typhoid bacillus in the agar tube and in two of the gelatine tubes. He says that evidently the vitality of the typhoid bacillus is not destroyed by freezing.

ONE OF THE METHODS by which infectious diseases may find an entrance into a country is exemplified in the history of the introduction of cholera into the Argentine Republic. On Nov. 1 of last year, the Italian ship *Perseo* arrived at Buenos Ayres from Genoa. During the voyage nearly a score of persons had died of cholera on the ship. The ambassador of the Argentine government in Italy was a passenger on the ship, and, in the anxiety of the ship's commander to permit him to land without detention, all sanitary rules seem to have been overlooked. The disease was not confined to Buenos Ayres, but was also conveyed by the same ship to Rosario, some two hundred miles farther, where there were at one time from twenty-five to fifty deaths daily. The disease still exists in both cities, but is very much less prevalent than formerly.

THE CONDITIONAL LIBERATION OF PRISONERS.

THE advances making in prison science, — or penology, as some are fond of calling it, — in this country are easily discerned. Not only do the annual meetings of the national prison congress attract wider attention and attract larger audiences, but there is a growing thoroughness and method in the current discussions on prison topics that stamps them as scientific. The reading public at large, moreover, take an interest in these subjects, for they appeal to them on many accounts, — ethical, economic, and philanthropic.

In the *International record of charities and correction* has appeared a paper by the editor of that journal, which was read by him before the recent meeting of the prison congress at Atlanta, and which not only typifies the scientific method of treating prison questions, but shows its application to a particularly interesting subject. Mr. Wines discusses, in the article in question, con-

ditional liberation, or the paroling of prisoners. He points out both the close relation and the distinction between the so-called indeterminate sentence and the conditional discharge of a convicted criminal under parole, and says, that, while in Europe the tendency has been toward conditional liberation under sentences which are of fixed duration, in the United States we incline to an indefinite sentence. On both continents the first experiments in conditional liberation have been made with juvenile offenders. As early as 1824 the charter of the New York house of refuge contained the germ of the theory of an indefinite sentence, and sixteen years later a law was passed by the legislature of the same state foreshadowing the principle of conditional liberation; but both acts referred only to offenders in their minority.

From the early experience of France, Mr. Wines adduces some significant statistics. In 1832 provision was made that prisoners discharged from *la petite Roquette*, the Paris prison for juvenile offenders, might be intrusted to a special society, which was authorized to apprentice them and watch over their conduct. The effect of this step was to cause a decrease in a few years of the percentage of juvenile recidivists from seventy-five to seven per cent. It was then proposed by an eminent judge that the plan which had proved so successful with juveniles be made applicable to adult criminals, but it is only very recently that this was done.

With respect to adults, the English, in their 'ticket-of-leave' system, were the first to try conditional liberation. Until 1853 this ticket-of-leave provision only applied to convicts shipped to Australia, but in that year it was extended to include convicts incarcerated on English soil. In more recent years the value of the system of conditional liberation has been more widely appreciated. It was adopted by the grand duchy of Oldenburg and the kingdom of Saxony in 1862, and its success in Saxony was such that it was embodied in the criminal code of the German empire, which took effect in 1871. In 1868 it was adopted by a Swiss canton, and in the following year by Servia. Denmark put it in application in 1873, as did the Swiss canton Neuchâtel. Croatia, and cantons Vaud and Unterwalden, followed, as did the Netherlands in 1881, and France in 1885. In 1882 Japan adopted it, and it is a portion of the criminal codes under discussion in Austria, Italy, and Portugal. The first recognition of the principle of conditional liberation in the legislatures of the United States was in 1868, when the state of New York established the Elmira reformatory.

The objection that a parole is a pardon, and must be granted under the laws and conditions governing pardons, Mr. Wines notices at some length. He holds that a parole is not a pardon, for the reason that when a convict is pardoned his liability under the law ceases; but when he is paroled, and until his conditional release merges into one that is absolute, he is still in the custody of the law and under sentence. This being an important point, Mr. Wines discusses it in detail. He shows, that, if a parole is unconstitutional, so is the time allowance now made in almost every state in the union to the convict, for good behavior while in confinement; and adds that "the history of the discussion of the indeterminate sentence, both at home and abroad, shows that until this legal, quasi-constitutional objection to it is disposed of, no progress can be made in the way of securing a candid and careful consideration of its practical advantages."

Passing from the legal to the practical side of the question, Mr. Wines claims, that, not only the *a priori* argument, but the results of its practical workings, are entirely in favor of the system of conditional liberation. Applied in any prison, it affects both officers and convicts. The former have a new responsibility thrown upon them, that of "judging at what moment each convict committed to their care is fitted for the test of character outside of the prison enclosure;" while the latter, finding his hope and his desire of personal freedom called upon, becomes an efficient and willing co-operator in his own amendment. "The system wakens in the breast of every prisoner who is not sunk in intellectual or moral imbecility, the sense of individual responsibility, and stimulates it to the highest degree of activity which he is capable of sustaining." The system is also recommended to students of criminal jurisprudence, because of the benefits it will confer upon society at large. It lessens the suffering of the family and friends of the criminal, and it diminishes the expense required for his maintenance. It is at once a thorough and the only practicable means of testing the prisoner's reformation in prison.

Mr. Wines does not overlook nor pass by the practical difficulties which are urged against the adoption of the system he is advocating. He considers them in turn. The first of them is "the ignorance and apathy of the public with reference to every phase of the question of prison discipline." As this has stood in the way of many important reforms before now, and has always had to yield in the end, Mr. Wines declines to give it any serious attention. It will cure itself. To the objection that a prisoner is naturally a hypocrite, and

that therefore no correct judgment can be formed as to his improved character, it is answered, "How does this apply to the system of conditional liberation any more than to the good-behavior laws now so common?" In the United States, concerted action on the part of the various states would be necessary, in order to operate the system effectually. No special watching of the paroled convict is desirable, and the writer quotes prison-director Sichart of Wurtemberg, to the effect that police surveillance is undesirable; for the paroled prisoner should not be subjected to unnecessary mortification. What he requires is protection against any hinderance which may exist to his honorable success; and in no event should surveillance of any description be continued longer than the circumstances of each case seem to require.

Mr. Wines then develops his ideas as to the classes of convicts to whom the privilege of conditional liberation should be granted, the stage of imprisonment at which a parole should be granted, and the authority to whom the discretionary power of granting the parole should be entrusted. Statistics are quoted showing, that, of 1,695 paroled prisoners in Bavaria, only 59 relapsed; of 782 in Wurtemberg, only 8 relapsed; and of 286 in Saxony, only 6 relapsed. The statistics on this point gathered from the experience of the New York state reformatory at Elmira, are already known to our readers.

LONDON LETTER.

THE character of the Friday-evening lectures at the Royal institution (the scene of the labors of Davy and Faraday) is probably well known to most readers of *Science*. The after-Christmas series was opened by Sir William Thomson, who discoursed to a brilliant audience upon the probable origin, extent, and duration of the sun's heat. Adopting, apparently unreservedly, Helmholtz's theory of its origin being due to the shrinkage of its mass, owing to gravitation, he pointed out that gravity was $27\frac{1}{2}$ times as great at the sun (at present) as at the earth, and how different, therefore, solar physics were from terrestrial. The mystery of the relation between gravitation and the other properties of matter had hitherto proved insoluble. A body falling through only forty-five kilometres on to the sun's surface, would develop more energy than any known chemical combinations, and hence he relegated such combinations to the domain of the determining influences of merely incidental changes. Much time was devoted to calculations of solar energy from the point of view of the 'mechanical equivalent of heat.'

The amount of solar shrinkage was probably about 0.01 per cent of his diameter in 2,000 years. Fifteen million years ago the sun was probably four times its present diameter, and in another twenty million, its density will equal that of lead, and the activity of solar radiation will probably greatly diminish. At present it was about 75,000 horse-power per square metre. Looking back, although biology demanded more time, the study of dead matter would give twenty million years as a maximum past limit, and ten million years as a maximum future limit, of the heat received at present by the earth from the sun. The speaker created some amusement, towards the end of his discourse, by admitting that 'However, after all, we know nothing whatever about it!'

The Prince of Wales has just been elected an honorary member (probably the first British one) of the Linnaean society, which has hitherto been somewhat chary of bestowing its 'parchments sealed with wax.' This famous society was founded in 1788, and is the owner and custodian of the library, manuscripts, and herbarium of the illustrious Linnaeus, who died in 1778. These were originally bought from his family for about \$5,500, by Dr. James Edward Smith, who founded, and was first president of, the Linnaean society, which has comprised in its roll all the most distinguished naturalists of the day, and may be considered to be a select club of scientists.

The 'Christian evidence society' aims at counteracting the atheistic spirit which is alleged to be spreading among the masses in London. Latterly, its purely theological meetings and lectures have been frequently supplemented by lectures on scientific subjects delivered by men of well-known scientific position. In the west end of London, during the present month, the presidents of the Royal and of the Linnaean societies (Dr. Stokes and Mr. Carruthers) will take part in such a course, the former taking for his subject, 'Is the demand for demonstrative evidence in religion reasonable?' Dr. J. H. Gladstone and Mr. W. Lant Carpenter also take part in this course.

On Jan. 17 a notice was issued by the post-office cancelling all previous notices as to delay in the telegraph service owing to the break-down occasioned by the storm of Dec. 26. For the week ending Jan. 15, the number of messages was 803,000, as against 736,000 for the corresponding week of last year, notwithstanding the fact that senders were warned as to probable delay. The department has been able to have this good record while the wires were down, mainly through the free use of the Wheatstone automatic fast-speed transmitter, which for a long time has been doing 700 words per minute (350 in each direction, the line

being duplexed) over one wire between Newcastle and London, about 300 miles. Every effort was made to get messages through, no matter how circuitous the route. Some messages reached London from Paris *via* New York. In the angry controversy which has been raging on overhead *versus* underground lines, the following statements have been put forward on authority: The English post-office has 20,000 miles of underground lines, as against 22,000 in Germany. The cost of an underground wire is £350 per mile, and of every additional wire, £15, as against £35 and £10 respectively for overhead wires. Underground wires diminish the speed of signalling from 25 to 75 per cent over long distances. The cost of renewal and maintenance is about the same in both cases.

The present year is the jubilee of the queen's accession to the throne. There is considerable fear that the proposal for an 'Imperial institute,' as a commemoration thereof, will not be adequately supported, and, in scientific circles, much feeling exists at the scanty recognition of science in the constitution of the committee (nominated by the Prince of Wales) which framed the scheme, and, *a fortiori*, in the scheme itself.

An interesting history of the 'Science and art department' has just been issued, showing its growth during the last fifty years, and the encouragement given by the state in this way to instruction in science and art. Its headquarters are in South Kensington, which is in connection with about 1,500 scientific schools all over the United Kingdom. Twenty-five distinct branches of science are taught, and the annual grant for its maintenance approaches half a million pounds sterling. This is mainly distributed on the results of the May examinations, held at the end of the winter's teaching. In connection with this are the scholarships due to Sir Joseph Whitworth's contribution of £3,000 per year, given in 1868.

W.

London, Jan. 22.

HONOLULU LETTER.

MR. E. D. PRESTON of the U. S. geodetic survey has just arrived and begun work under temporary engagement with the Hawaiian government survey. His task is to establish a normal or standard latitude for this group. The latitude of several points has already been carefully determined, — two such in 1883 by Mr. Preston in connection with pendulum observations, and some others by the British observers of the transit of Venus. Since full geodetic results have been obtained by inter-island triangulation, serious discrepancies are found to exist between these and

the astronomical determinations of latitude, rising as high as forty-five seconds of latitude in the relative positions of stations on neighboring islands. The study of these discrepancies shows them to be due to local deflections of the vertical in consequence of the powerful attraction of our great mountain-masses. The error produced appears to be greater than in any other part of the world in proportion to the extent of the geodetic work. A discrepancy in longitude of sixty seconds is found to exist between Kailua and Honolulu, 150 miles distant. These longitudes were determined by the British transit expedition, transporting twelve chronometers three round trips between the stations. The mountains of these islands rise above the sea from 4,000 to 14,000 feet. But being surrounded by a depth of ocean of, say, 25,000 feet, the masses are really from 30,000 to 40,000 feet high, fully accounting for the extraordinary deflection of the vertical. Twelve stations have been selected whose positions are precisely determined, and which lie on opposite sides of their respective islands. Mr. Preston will occupy each one, so as to secure at least one hundred observations of pairs of stars. It is believed that a study and comparison of the discrepancies between the latitudes obtained will enable a standard latitude to be determined for the whole group, very closely approximating to the true latitude.

No precise determination of longitude can possibly be obtained until there is cable communication between Honolulu and the continent. It now seems probable that such communication will soon be established. Mr. Preston's work will then be available in corrections to determine a standard longitude as well as latitude for this group. When these corrections for the latitude and longitude are applied to the transit of Venus station at Honolulu, it seems not unlikely that better results may be obtained from the work done by the British transit expedition.

A panorama of the caldera of Kilauea goes today to the United States for public exhibition. It is an accurate representation of the great enclosure, and of the interior active lakes, as seen at the period of culminating action shortly before the periodical collapse which took place last year. The work is by an eminent artist, Jules Tavernier, who is particularly successful in vivid representation of incandescent lava. The whole is lifelike and realistic. Although startling, it possesses a high scientific value, far beyond a mere popularizing of the subject.

Since the collapse, the lava has re-appeared in force, and is slowly rising in the lakes, already presenting brilliant exhibitions. After a period of the highest activity, the lakes suddenly sank out

of sight, leaving deep pits, the bottoms of which were 700 feet lower than the previous level of liquid lava. The surveyor-general embraced the opportunity for a precise survey of Kilauea and its branch craters, which has been completed. It will probably be several years before any thing like the recent high level of lava is again attained. A remarkable phenomenon still proceeding has been the uplifting from the bottom of the pit, as if by colossal jack-screws, of a veritable mountain island of lava more than 500 feet in diameter and 150 feet high, around which the liquid lava flows. This permanent island has already risen some 300 feet within seven months. The best facilities are now given for access to the crater, involving five days' absence from Honolulu, at the cost of fifty dollars, covering all transportation, hotel fare, and guides, with two days at the crater. K.

Honolulu, Jan. 18.

GEOGRAPHICAL NOTES.

Asia.

Dr. A. Bunge and Baron E. Toll have returned from their journey to the New Siberian Islands. They have made valuable collections and observations on the five islands of this group, which of late became so famous by the hazardous boat journey of the Jeannette crew. The results of this, the first scientific expedition to these islands, will be of great interest.

There are new reports on Potanin's expedition to southern Mongolia. His return was announced in the St. Petersburg letter of last issue. Potanin left the district of Koko-Nor on June 25, 1886, crossed the desert of Gobi on a previously unknown route from south to north, and discovered four parallel chains of mountains, which form the south-eastern continuation of the Altai system. The journal of the Imperial Russian geographical society contains a report on his last exploration in the district of Koko-Nor. He explored that part of the Nan-shan mountains which separate the country drained by the Hoang-ho from the plains of southern Mongolia. It is composed of three mountain ranges, with passes 12,800 feet in height, and intermediate valleys at an elevation of 10,000 feet. On his way north he fell in with the Jegurs, a tribe hitherto unknown. Potanin surveyed the whole country he traveled over, and determined the position of seven places by astronomical observations. His companion, the naturalist Beressowski, will stay near Kiachta until next winter in order to complete his collections.

Mr. E. Michaelis, in *Nature* of Dec. 16, states that traces of the ice-period are found in the southern parts of the Altai Mountains. Farther

south, on the northern declivity of the ranges Jarbagatay and Saoor, which form the southern limits of the basin of the Irtish, large deposits of boulders are found. They consist of granitic rocks, which have been carried by the ice from the crest of the mountains to a distance of about ten miles, the layer having a direction from south to north. The range of Saoor attains a height of about 12,500 feet above the level of the sea. At the present period snow always lies on its highest parts, but no glaciers are found.

According to Nikolsky, Lake Balkash is drying up at the rate of one metre in fourteen or fifteen years. Its southern portion, called Ala-Kul, is being transformed into a salt-pan similar to Kara Bugas, the well-known bay on the east side of the Caspian Sea. As the evaporation is very rapid in those regions, and the bays have no tributaries, the loss of water is replaced by the salt water of the lake rushing through the narrow entrance into the bay, the water of which having become concentrated, the salt is continually being precipitated at its bottom. Some other lakes of West Siberia and the Aralo-Caspian region are also drying up. Jadrienzew, by comparing the extent of the Lakes Suny, Abyshkan, Moloki, and Chany, in the governments of Tobolsk and Tomsk, as represented in maps of 1784, 1813-20, 1850-60, and 1880, proves that they are desiccating at a rapid rate. Lake Abyshkan measured 530 square miles at the beginning of this century, while only three small ponds of one and a half miles in width remain. The same process is going on throughout West Siberia.

According to the *Novoe Vremya*, the trading caravan lately despatched by the Central Asian commercial company Koudrine has passed through Kashgar and entered Thibet. This company is likely to play an important part in Central Asia. It has established permanent agencies at Merv and Askabad, and in the Persian cities of Kutchan and Meshed, and now it proposes to do the like in Thibet. It has received from the Ameer of Bokhara a large tract of land on the banks of the Amu-daria, near the Chardjui station of the Transcaspian railway, for the cultivation of cotton. In the Transcaspian there seems to be a great district suitable for cotton-growing, and there is a general opinion among the commercial classes of Russia that the development of this industry ought to be steadily encouraged by the government.

Africa.

Further news has been received from Dr. Oscar Lenz, dated Kibonge, April 20, Nyangwe, May 19, and Kasonge, June 1. Lenz left Stanley Falls on March 30 in canoes supplied by the famous Ara-

bian trader, Tippo-Tip, who sent several Zanzibari soldiers with him, and gave him about twenty negroes for oarsmen. At the cataracts they had to hire natives, as the work was too hard for the small company. Having left Stanley Falls, they passed through a dreary country, the banks of the river being low and covered with thick forests. On account of high water they had great difficulty in finding places for camping. Lenz found many of the native villages mentioned by Stanley deserted, as the natives had settled farther inland to escape the attacks of the Arabs. He met Zanzibari soldiers belonging to Tippo-Tip's troops in most of the villages, who gave him some trouble by trying to tax him. It took the small caravan seven days to pass the cataracts of Wamanga, having several times to transport their bulky canoes over marshy, bush-covered ground. On April 15 they reached Kibonge, which is largely inhabited by Arabs and Zanzibaris. It is named after the chief who established the village nine years ago. He came from Nyangwe, and is independent of Tippo-Tip. The village is very extensive, and is composed of a great number of ranches, with gardens and fields. Its situation, however, is very unhealthy, as it is built on the low banks of the Kongo, and large lagoons and swamps surround it. As the district is very suitable for rice culture, the Arabs have cleared the land, and grow considerable quantities of rice. Lenz considers these fields far more extensive and numerous than those in West Africa. He left Kibonge in company with several Arabian traders, who were going to Tippo-Tip's station, Riba-Riba. A few days' journey above Kibonge they heard the sounds of the war-drums of the natives, and prepared for defence in case of an attack. Wherever the Arabs have settled, the negroes have fled into the woods, and when they have a chance of attacking the intruders with safety they do so, and the Arabs are in constant fear of their poisoned arrows. The feeling of uneasiness did not subside until they had reached the friendly tribes near Riba-Riba. The latter place derives its name also from its chief, a Nyangwe negro. The river between Nyangwe, and Riba-Riba, and Kibonge is frequented by travelling parties going from one place to another in pursuit of their trade. They extend their journeys far up the tributaries of the Kongo, as far south as Urua, south-west of the Tanganyika. Nyangwe is built on a hill about a hundred feet above the Kongo. It consists of a number of houses surrounded by gardens. The inhabitants are rich Arabian merchants and Zanzibaris and natives who are in their employ. Some houses are well built of sun-dried bricks and have fine piazzas. Kasonge, the headquarters

of Tippo-Tip, is far more important than Nyan-gwe, being the place where caravans to Lake Tanganyika are fitted out. Tippo-Tip, whom Lenz had left at Stanley Falls, arrived at Kasonge about the time of Lenz's arrival, and as he was going to Zanzibar, Lenz feared that he would not be able to get a sufficient number of men for his caravan. Later telegraphic news informs us that Lenz was compelled to abandon his intention of reaching Dr. Junker and Emin Pacha (Dr. Schnitzler), and a short time ago the cable informed us of his arrival at Zanzibar. He has crossed the continent from the mouth of the Kongo to Zanzibar in less than eighteen months.

Lenz's remarks on the Arabian trade with Urua are of interest when compared with the views Captain Cameron expressed at the London institution, on Jan. 11, 1887. While Lenz emphasizes the difficulty the Kongo Free State and other European powers will encounter by Tippo-Tip's powerful influence in Kasonge and Urua, Cameron thinks that, by following the Lomami, the London missionary society's agents and the officers of the Kongo Free State would soon reach this country, and he expresses great hopes of their being able to do away with the horrors of the slave trade which prevails there owing to the Portuguese and Arabs.

Lieutenant Webster, late commander of the station of Stanley Falls, proposes to explore the district between Adamaua and Kameroun. This is the region which Robert Flegel tried to enter from the upper Benué. Here the unknown area almost extends to the coast, and the obstacles arising from the hostility of the native tribes have hitherto prevented all explorers from entering the continent.

The Italian traveller, A. Franzoj, has determined to abandon his intention of crossing the Somal country, on account of the unsettled state of affairs in that district. He will go to Zanzibar, and proposes to follow Thomson and Fischer's route through the Massai district.

Dr. K. Jühlke, of the German East-African company, was murdered in Kismayu in the beginning of December. After having purchased Usagara and the neighboring countries in 1884, he added to the possessions of the company, in June and July, 1885, the district as far north as the Kilimanjaro, and, on his last expedition, that from Vitu to the mouth of the Yuba.

Captain Rouvier, member of the joint commission of France and the Kongo Free State for determining the boundary line of the possessions of both states up to longitude 17° E., has made a survey of his routes, which, it is hoped, will be a great advance in our knowledge of the geography of the Kongo River. His observations show that

Stanley Pool is far smaller than it was supposed to be, and that the positions of many places and rivers require changing.

Henry M. Stanley left Suez on Feb. 6, on the steamer Navarino, for Zanzibar direct.

The German East-African company has been converted into a corporation by a committee of the founders, merchants, and financiers. The board of directors will hereafter consist of twenty-seven members, three of whom are to be nominated by Prince Bismarck. The capital is to be raised to 5,000,000 marks by a further issue of shares.

America.

Dr. P. Ehrenreich and K. von Steinen sailed from Hamburg last week for Brazil. They intend to explore the southern tributaries of the Amazon.

Oceans.

At a meeting of the Paris Academy of sciences on Jan. 10, a report was given of experiments made by the Prince of Monaco to determine the direction of the North Atlantic currents. Of 169 floats thrown overboard 300 miles north-west of the Azores, in 1885, 14 have been recovered, showing a general south-easterly direction and a mean velocity of 3.83 miles per 24 hours. Of the 510 floats thrown overboard in 1886, much nearer the French coast, 9 have been recovered, showing nearly the same direction, with velocities of from 5.80 to 6.45 miles.—*Nature*, Jan. 20.

NOTES AND NEWS.

THE plans of the Johns Hopkins university have always had reference to the establishment of a faculty of medicine whenever the Johns Hopkins hospital should be completed. The buildings are nearly ready to be occupied, and arrangements will be perfected for instruction in surgery and medicine. Meanwhile, courses preliminary to the study of medicine, especially in physics, chemistry, and biology, with the modern languages, are provided in the philosophical faculty. The nucleus of the medical faculty, as now constituted, includes the president of the university, a professor of pathology, a professor of physiology, a professor of chemistry, a lecturer upon hygiene, and an associate in pathology.

— During the past year the Institute of social science of New York has held twenty meetings, at which were presented and discussed the following papers: 'The logical method of studying sociology,' Mr. Parke Godwin; 'An introduction to social science,' T. B. Wakeman, Esq.; 'Principles that should control the interference of the state in

industries,' Dr. H. C. Adams; 'The fiscal problem of all nations,' Prof. J. C. Zachos; 'Neglected factors in social reform,' Rev. Dr. A. H. Bradford; 'English socialism, especially co-operation, and the Christian socialistic movement,' Dr. E. R. A. Seligman; 'Heredity and opportunity,' Dr. Lester F. Ward; 'Criticism of Seligman's paper,' Mr. Edward King; 'The land question as presented by Mr. Henry George,' Professor Molina; Discussion of Dr. Adams's paper of April 8; 'Karl Marx's theory of value,' Mr. Ewald Langerfeld; Discussion continued of Dr. Ward's paper of June 10; 'The demands of labor,' Mr. Edward King; 'Free competition vs. state socialism,' Mr. Justus O. Woods; 'The moral aspect of the economic question,' Prof. Thomas Davidson; 'A practical view of protection,' Mr. Robert P. Porter; 'The basic law of ownership,' Mr. Edward G. Clark; 'The cause and cure of crime,' Mr. W. M. F. Round; 'The economic heresies of Mr. Henry George,' Mr. George Gunton. The papers generally were very meritorious, and several of them were published in the leading periodicals and journals, and others in pamphlet form. The institute has thus aided in elucidating social topics which are commanding so general and pressing public attention. One member of the institute has successfully organized two popular classes for the systematic study of social economics, and others are being formed. Three or more of the members are preparing books on this subject for publication. Those who have followed carefully the papers and their discussion bear emphatic testimony to their usefulness. It is worthy of remark that the result of the discussions has been favorable to conservative opinion, and proves that healthful social progress will come through a more general and better understanding of the principles underlying social economics. The discussion of the papers has taken sometimes too much the form of debates, in which the contention seemed rather for victory than truth. Disputants have not always confined themselves to the topic discussed, but have disputed with each other points not involved in the papers.

—Strenuous efforts are being made to induce the legislature of the state of New York to enact the amendments to the present tenement-house law of the city of New York, which were prepared by the tenement-house commission of 1885. The act provides that every tenement shall have a dry cellar, good drainage, ample water-supply, and a janitor; owner's name to be registered; a semi-annual inspection by the board of health, and an annual report; free winter baths; electric lights in tenement district; and cutting through Leonard Street to open up the Mulberry Street

'bend.' Petitions are now being circulated in behalf of this law. The citizens of Brooklyn are also moving in the matter of tenement-house reform, the law in that city being practically the same as it was twenty years ago, and the tenement-houses lacking many of the improvements which are to be found in New York. The amended ordinances which were forwarded to the common council of Brooklyn nearly two years ago still remain unacted upon, and efforts are now being made to have them adopted by that body. For this purpose a meeting has been called by the commissioner of health, of builders, architects, physicians, and philanthropists, to consider and revise these ordinances before their final adoption.

—Mr. H. C. Russell, government astronomer for New South Wales, and late president of the Royal society of that colony, gave an account in his last presidential address of certain oscillations, or *Seiches*, as the Swiss call them, in the waters of Lake George (New South Wales), as determined by the record of an automatic evaporation gauge. The lake is about eighteen miles long, five wide, and fifteen or twenty feet deep: its oscillations have an amplitude of from two to six inches, and are of two periods; the longer being two hours and eleven minutes, the shorter one hour and twelve minutes. In most cases the motion is connected with the passage of thunder-storms; but at other times it seemed to arise from the repeated and well-timed impulses of a less apparent force. For example: on one occasion, when the lake was very quiet, the water suddenly rose an inch, and fell again within thirty minutes; then it rose an inch and a half, and fell two inches in three-quarters of an hour; next it rose two inches, and fell three and a half inches in an hour; finally it rose three and three-quarters inches in forty minutes, and so started a series of pulsations which settled down to two-hour intervals, and lasted twenty hours.

—The Society of arts, England, offers two gold and four silver medals for the best motors suitable for electric-light installations, to be competed for in London next May or June. The motors will be divided into two classes, — those in which the working agent is produced (steam and gas engines), and those in which the working agent must be supplied (steam, gas, and hydraulic engines).

—The following is a copy of a note found by Mr. J. C. McClure on the south side of Nantucket, Jan. 29, 1887: "This bottle was thrown overboard from schooner Emma L. Cottingham, July 20, 1886, in latitude 41° 06' north, longitude 69° 08' west. Any person finding this will confer a favor by

sending this to the hydrographic office at Washington, D.C., stating when and where found." The note was signed "J. L. Somers, schr. Emma L. Cottingham, of Somers Point, N.J."

— Three more sheets of the topographical atlas of New Jersey are issued, making thirteen out of the seventeen for the whole state. The new sheets are named after their chief places, Trenton, Mount Holly, and Camden. The remaining sheets will probably be completed in 1888.

— The report of Lieut. William H. Schurtze, U.S.N., on his official trip to Russia to distribute the testimonials of the government to the subjects of Russia who extended aid to the survivors of the Jeannette exploring expedition, was presented to congress last week. The report is quite long, and records in detail the movements of the lieutenant and the results of his observations. Accompanying the report are copies of two charts the existence of which Lieutenant Schurtze believes have been forgotten outside of Russia. He says, in view of the general interest taken in anything pertaining to the Jeannette expedition, it seems that these charts are worthy of special consideration, because they relate directly to two regions most prominent in the history of the expedition, namely, Bennett Island and the Lena Delta, North Siberia.

— The U. S. coast and geodetic survey report for 1885 — Appendix No. 10 — contains a paper by Charles O. Boutelle, who gives practical suggestions for geodetic reconnaissance, such as he derives from his long experience in field-work. His information on the selection of base-lines and stations for triangulation will be useful for topographers.

— In 1882 small-pox was very prevalent in New York, there having been 708 cases with 259 deaths. In 1883, only 26 cases and 12 deaths occurred; in 1884, 5 cases and no deaths; in 1885, 105 cases and 26 deaths; and in 1886, 109 cases and 31 deaths. During the week ending Jan. 29 of the present year, there were 23 cases, of which 3 proved fatal.

— The health commissioner of Denver, Col., reports that in 1886 there were 195 deaths from consumption in that city, only five of which originated in the state of Colorado.

— The U. S. geological survey is engaged in the preparation of a detailed topographical map of the vicinity of Washington, Alexandria, and contiguous parts of Maryland and Virginia. It is intended to show the elevation by contours at twenty-five feet intervals, showing the curvature of the earth as it rises from the sea-level. The

existing coast-survey work in this neighborhood will be incorporated in the new map. This will be the first authentic topographical map, on a trigonometric basis, of the District of Columbia and its surroundings. The coast-survey steamer Hassler arrived at the Mare Island navy yard last week, and will soon go north to the Alaska coast and resume work in that vicinity.

— Dr. Hinrichs has lately published a comparison of the weather-predictions of the signal service for last August, as indicated by flag-signals hoisted at Iowa City, with the weather occurring in the period for which the predictions were made, getting the following results:—

Predictions.	Facts.
Colder, 7 days.....	3 days, average difference from preceding noon, 3°.3 colder. 4 days, average difference, 4°.0 warmer.
Stationary temperature, 13 days.....	8 days, average difference, 3°.6 colder. 5 days, average difference, 4°.8 warmer.
Warmer, 8 days.....	3 days, average difference, 3°.6 colder. 4 days, average difference, 1°.8 warmer. 1 day, no change.
Local rain, 11 days.....	2 days, no rain. 4 days, rain not measurable. 3 days, rain barely measurable. 2 days, appreciable rain.
Fair weather, 20 days....	2 days, appreciable rain. 1 day, violent thunder-storm, with heavy wind and rain (others not mentioned).

Dr. Hinrichs concludes that it is exceedingly unfavorable to the people's confidence in the flag-display of the signal service, when its fair-weather flag is beaten by storm and rain, and when its rain-flag flutters lustily and dryly in a hazy, balmy atmosphere of summer.

— A valuable Algonquin-French lexicon (*Lexique de la langue Algonquienne*) by the distinguished philologist, the Rev. J. A. Cuoq, has lately been published (Montreal, J. Chapleau et Fils). The Algonquin, as the name is here used, is the language of that tribe of Indians who formerly possessed the country about Montreal, and of whom some bands still remain in the neighborhood of that city. Their speech has a special importance, both scientific and historical. As in the case of the author's Iroquois lexicon, there are interesting notes, linguistic and ethnological, on almost every page. The volume lacks the French-Algonquin part. It is to be hoped that the industrious author will hereafter supply this deficiency, as well as the similar lack which detracts from the usefulness of his excellent Iroquois lexicon.

— Prof. Max Müller's volume on 'The science of thought,' on which he has been engaged at intervals for several years, will soon be published. The author is occupied in it with the origin of

speech, which in his view, as in that of the Greeks, is identical with thought. A contribution of this sort to metaphysical science, from a writer who is at once a profound philologist, an able annotator of Kant, and the master of a most lucid and happy English style, will be expected with general interest.

— 'Harvard and its surroundings' (Boston, *Rand Avery Co.*, 1886), of which the seventh edition has just been issued, is designed to take the place of an intelligent companion to the visitor in his walk through Harvard and its vicinity, giving brief yet sufficiently definite descriptions of every place visited, with passing allusions to its leading historical and biographical associations, and devoting the larger proportion of space to the specially noteworthy objects.

— The *Athenaeum* prints the following: "The bibliography of learned societies is being enriched by a couple of useful publications now coming out in sections, — 'Die Wissenschaftlichen Vereine und Gesellschaften Deutschlands im 19 Jahrhundert,' by Dr. Joannes Müller; and the 'Bibliographie des Travaux Scientifiques et Archéologiques publiés par les Sociétés Savantes de la France,' published under the auspices of the minister of public instruction. Now, Mr. A. P. C. Griffin, of the Boston public library, proposes to issue by subscription a 'Bibliography of American historical societies.'"

— We learn from the *Athenaeum* that three important libraries of deceased professors have lately been sold in Berlin, — that of Professor Scherer, which was bought for 28,000 marks by an American university; that of the historian Waitz, which fetched 16,000 marks; and that of Professor Müllenhoff, which has been purchased for the new Germanische Seminar of the University of Berlin. Scherer's library is reported to have been one of the finest private collections in Germany.

— Kleiber of St. Petersburg has lately computed, in the *Meteorologische Zeitschrift*, the half-yearly variations of atmospheric pressure in the two hemispheres, taking January and July for the months of extreme conditions. He finds the mean pressure for the whole earth 759.20 mm. This result is necessarily the same for the extreme months, and the agreement of the author's figures serves as a check on his work. The mean pressure of the northern hemisphere is 760.31, varying from 761.80 in January to 758.82 in July: for the southern hemisphere, the figures are 758.09, 756.60, and 759.58. The mean pressure in the northern hemisphere thus exceeds that in the southern by 2.22. In July, when the northern

atmosphere is expanded and flows off to southern latitudes, the average northern excess is reversed to a slight deficiency of 0.76; but in January, when the cold of the land hemisphere is extreme, it accumulates more air than usual, and its excess rises to 5.20. It may therefore be said that a mass of air, equivalent to that which would give a pressure of 5.96 over a hemisphere, is periodically transferred from one side of the equator to the other.

— The report of the U. S. geological survey on the mineral resources of the United States for 1885 contains some interesting statistics. The total mineral product is valued at \$428,521,356, an increase of \$15,306,608 over 1884. Among seventy mineral substances cited, coal is the most important, showing a total value of \$159,019,596. An increase is shown in the production of coke, natural gas, gold, silver, copper, zinc, quicksilver, nickel, aluminum, lime, salt, cement, phosphate rock, manganese, and cobalt oxide, while the production of coal, petroleum, pig-iron, lead, precious stones, and mineral waters decreased. From the present outlook, says the report, it is probable that the total output of 1886 will prove much greater than that of 1885, and even larger than the prosperous year of 1882.

— A very valuable contribution to the study of cerebral localization is made by Dr. Henry Hun in the *American journal of the medical sciences* for January, 1887. The article records seven unusually interesting cases in which the symptoms were observed during life, and the lesions of the brain carefully examined after death. The results corroborate many of the current views on localization, and in a few points carry the process further than was possible before.

— The year 1886 has added eleven new asteroids to the list, which now numbers 264. Seven of the strangers were discovered by Dr. J. Palisa of Vienna, who has found no less than fifty-seven in all, while three were discovered by Dr. Peters of Clinton, who is now credited with forty-six. No. 258, Tyche, was found by Dr. R. Luther of Düsseldorf. No. 254 has been named Augusta; 255, Oppavia; 257, Silesia; 259, 260, 261, Aletheia, Huberta, and Prymno, respectively. The remaining four are still unnamed.

— The duplex principle has been successfully adapted to the Phelps system of inductive telegraphy, so that messages may be sent to and from moving trains in the ordinary manner without interfering with the transmission of messages by induction. With this improvement, a single line is all that is required for both train and ordinary telegraphy.

LETTERS TO THE EDITOR.

German constructions.

I DISAGREE *toto coelo* with my learned fellow-citizen as to what he is pleased to call 'horrible construction' in German, but believe, on the contrary, that for one whose ear is trained to it the sentences of qualification are as clear as an assemblage of short phrases, and ever so much more powerful. As an example of the involved style (seldom if ever used by the best German writers and speakers, by the way), take this:—

Dem, der den, der die, das Verbot enthaltende Tafel abgerissen hat, anzeigt, wird hierdurch eine Belohnung zugesichert.

This is tough for the anti-Teuton, but it says in eighteen words and ninety-five letters what cannot be literally translated into English in less than nineteen words and one hundred and four letters.

PERSIFOR FRAZER.

Philadelphia, Feb. 8.

Inertia-force.

Will you allow me to draw attention to one point in Dr. E. H. Hall's recently published pamphlet on 'Elementary ideas, definitions, and laws in dynamics,' which he seems to me to have treated with less success than he has the other points raised?

On p. 6 Dr. Hall says, "We have spoken sometimes of the force which is *applied* to a body to change its motion, and sometimes of the resistance or counter-force with which the body meets the applied force. Each is necessary to the other. We could not exert force upon a body if the body offered no resistance. On the other hand, resistance would be impossible if there were no applied force to be met. We shall call the counter-force, which a body in virtue of its inertia exerts to meet a force applied, the *inertia-force*." On what body this counter-force is supposed to be exerted is not at once clear. At first it seemed to me to be the body by which the applied force was exerted, the applied force and the counter-force being thus the opposite aspects of the same stress. And this seemed especially probable from the fact that on p. 24 the third law of motion (which of course applies only to the two opposite aspects of one stress) is cited to prove the equality of the applied force (there treated as doing work) and the counter-force (there called a resisting force). But the following quotations show that this is not Dr. Hall's meaning: "The force, or resistance, exerted by a body varies greatly with the conditions of the experiment, being sometimes large, sometimes small, according to the following general law: When the ball's motion is changed slowly, it offers a slight resistance,—a small force suffices; when a considerable change is to be effected in a short time, we encounter a large resistance,—a great force is required" (p. 5); and, "There is no change of motion, and hence no inertia-force is developed" (pp. 6 and 7). The counter-force may thus become zero, though the stress still act; and hence it cannot be one aspect of that stress. The following quotation, however, seems to settle the matter: "If one of the opposing applied forces is greater than the other, the greater will prevail, and a change of motion will occur, occasioning an inertia-force, which will work *with* the smaller applied force *against* the greater" (p. 7). The inertia-force, therefore, is supposed to act on the body by which it is exerted.

The magnitude of this inertia-force is determined, according to Dr. Hall (see above quotation from p. 5), by the magnitudes of the forces applied to the body; and the following quotation—"The working force and the resisting force must also be equal" (p. 24)—shows that just sufficient inertia-force is called into play in any case to satisfy the conditions of equilibrium.

Now, this sounds very like the old notion of centrifugal force. It was formerly held that a body moving with uniform speed in a circular path was acted upon not only by a force directed towards the centre of the path, and applied, say, by means of a string, but also by an equal force directed from the centre, called the centrifugal force, and exerted on the body by the body itself, which was accordingly considered to be in equilibrium. Dr. Hall's inertia-force is thus just a generalization of the old notion of centrifugal force.

Although Dr. Hall thus proposes to re-introduce what seems to be an old error, the only evidence he brings forward for his inertia-force is the assertion contained in the first of the above quotations, that, of the applied and inertia-forces, each is necessary to the other. Yet he does not leave us without means of judging of his theory of the 'resistance' which bodies offer to applied forces; for according to his own account of this inertia-force, as shown above, it both acts on, and is exerted by, the same body. Now, on p. 18 he admits that "every force implies an action between *two* bodies." Hence the supposed inertia-force cannot be a force at all. And again, as we have seen above, according to Dr. Hall's own account, all bodies must be acted upon by equilibrating systems of forces, if this inertia-force be taken into account; and therefore, if this inertia-force be a force, a body's motion may be changing though it satisfy the conditions of equilibrium.

Apparently Dr. Hall has been led to postulate this inertia-force, because, 1^o, he holds that a body resists an applied force (he even takes this to be a fact given in consciousness, for he says, p. 3, "One feels that the hand is *pulling*, that it encounters a *resistance*, which is offered in some way by the ball at the other end of the string"); and, 2^o, he cannot understand a force as being resisted in any other way than by the exertion of an opposing force. I agree with him that the term 'resistance' should in dynamics be restricted to the opposition of forces. But the manifest consequence is, that a body ought not to be said to resist a force, and that Maxwell's queries, quoted by Dr. Hall (p. 32)—"Is it a fact that matter has any power, either innate or acquired, of resisting external influences? Does not every force which acts upon a body always produce exactly that change in the motion of the body by which its value as a force is reckoned?"—are to be answered, as Maxwell evidently intended them to be answered, the former in the negative, the latter in the affirmative, though some of his own definitions may be thereby shown to be worded in a faulty manner.

I hope I have not misrepresented Dr. Hall's position. I have read his pamphlet carefully several times, and can get only one meaning out of it. Were I reviewing the pamphlet, I would find many points to praise; and I draw attention to the above apparent error only because the excellence of the pamphlet generally is likely to cause it to take root and spread.

Dr. Hall, in his appendix, quotes a passage from Minchin's 'Uniplaner kinematics' which seems to

show that he has high authority for his inertia-force. But that Newton's *vis insita* or *vis inertiae* is quite a different thing from Hall's inertia-force, will be evident from the following quotations: "Haec" [*vis insita*] "semper proportionalis est suo corpori, neque differt quicquam ab inertia massae, nisi in modo concipiendi" (Newton's *Principia*, comment on def. III); and "Inertia and inertia-force must be carefully distinguished" (Hall's pamphlet, p. 6). Minchin's 'force of inertia' is just D'Alembert's 'effective force,' and is not a force at all, but simply the name given to the product of the mass of a particle into its acceleration.

J. G. MACGREGOR.

Halifax, Jan. 31.

An Ohio mound.

In company with five young men from the public school of this place, on Saturday, Oct. 10, 1886, I assisted in the exploration of a mound, located in the northern part of Van Buren township, Shelby county, O., an account of which may be of interest to antiquarians.

Twenty-five years ago the mound was ten feet high, and twenty feet in diameter at its base. It was opened at that time by a Mr. Robinson, the owner of the farm, and a neighbor, but nothing was discovered by them beyond the fact that it contained a deposit of the fragments of bones, ashes, and red earth. A more careful examination, however, made by digging a trench four feet wide through it from east to west, revealed the fact that it was not only a place of deposit for dead bodies, but a place where human bodies were consumed by fire. A large portion of the interior of the mound is composed of calcined bones. Many of these bones, since their calcination, have been filled by carbonate of lime, and are now as hard and heavy as stone. There were, no doubt, a few copper implements or ornaments deposited with the bodies, as the bones are all highly colored with the salts of that metal. A careful examination, however, failed to discover specimens of the metal. A quantity of mica, sufficient to give the *débris* a glittering appearance, was found diffused through the entire mass. Deposits of red clay were found in different portions of the mound, of a deeper red than the red color produced by the action of fire.

One curious feature of the contents of the mound was the large number of balls found, varying from a half-inch to two inches in diameter. They have all been burned, and are of about the hardness of soft-burned bricks. The only relics found were a few small fragments of pottery and a green slate tablet three inches long, pierced by a hole at one end.

C. W. WILLIAMSON.

New Bremen, O., Feb. 3.

A method of labelling museum specimens.

The task of so labelling a collection of rocks, minerals, or similar objects, that their identity can in none but the most extreme cases be lost, is no light one. A common method now employed consists in painting a small area upon the object, which serves as a background upon which the serial number is again painted in a different color. Although the results thus obtained are lasting, the method is too laborious. Another common method consists in writing the requisite data with pen or pencil upon a

slip of paper, which is then gummed to the specimen. This is, however, worthy only of universal condemnation.

After several years' experience in dealing with rock collections, I have adopted the plan given below, which is but a modification of that first mentioned. Its advantages are, ease and rapidity in application, legibility, and durability of results. The method, then, is briefly this: take common lead paint, of any desired color, and mix with ordinary varnish and a very little turpentine instead of oil. Apply with a brush over an area sufficiently large to accommodate the catalogue number, or whatever data it may be desired to put upon it. This quickly dries, giving a smooth, glossy surface. With very vesicular rocks, as some of the recent lavas, it is often best to even the surface by means of a little plaster-of-Paris, applied with a knife-point, before painting the stripe. Then take tube paints, — I use Winsor & Newton's lamp-black, — mix thin with turpentine, and with this and a common steel pen write the number on the surface prepared as above. If the paint is just the right consistency, — and this can be learned only by experience, — the numbers can be written almost as rapidly as with a pencil on paper. Both paints had best be mixed in watch-glasses, or some shallow vessel that can be readily cleansed, as they are, of course, useless after once having become hard and gummy.

On colorless crystals, such as quartz, the number can, perhaps, be best written with a marking-diamond. On smooth dressed specimens, as polished marble, the numbers can be written with pen and paint without the first stripe. On account, however, of the great diversity in color and texture of materials, I have found it best to adopt a uniform system for all, — a light-blue base with figures in black. Any other sufficiently contrasting colors will, of course, do as well.

GEORGE P. MERRILL.

U.S. nat. mus., Feb. 5.

Fish parasites in Meleagrinae.

The occurrence of parasites or commensals in the pearl-oysters or mother-of-pearl shells has been known for a long time. Several years ago (1874), Professor Putnam of Cambridge described, in the Proceedings of the Boston society of natural history, *Fierasfer dubius*, a small fish common to both coasts of Central America, which sometimes inhabits holothurians on the Atlantic, and pearl-oysters on the Pacific side; and he referred to a specimen of the pearl-oyster in the Museum of comparative zoology, in which a *Fierasfer* is embedded in the nacreous substance of the shell.

In June last Dr. Gunther, at a meeting of the Zoological society (London), exhibited a similar specimen.

About a year ago, while examining certain material belonging to the Mexican geographical commission, I detected probably the same species enclosed in nacre in a pearl-oyster valve from the Gulf of California, and two, if not three, instances of another species of fish, apparently an *Oligocottus* (in the opinion of Dr. Bean), similarly enclosed. The occurrence of a crustacean, the pea-crab (*Pinnotheres*), under the same conditions, in a pearl-oyster shell from Australia, was made known to the Zoological society last April by Dr. Woodward. The forthcoming report of the national museum will contain a

more ample description with figures of these interesting parasites or commensals.

ROBT. E. C. STEARNS.
U. S. nat. mus., Washington, Feb. 2.

National prosperity.

My attention has been called to the comments of Mr. C. H. Leete upon my January article in the *Century magazine*. Mr. Leete objects to making the year 1865 a basis for the comparison of progress. The details of each year were given, and he could choose for himself any year in the series from which to date progress. Perhaps it may be interesting to submit the enclosed more ample table, showing progress from 1870 up to the present date. In respect to cotton, the ante-war crops are given as well as the post-war crops. The gain subsequent to the war, as compared to the twenty-one years previous to the war, has been much greater than before, for the reason that for every cent per pound added to the price of cotton under the slave system, \$100 was

property insured against loss by fire, they represent the progress of the million in the means of common welfare rather than of the millionaire in personal wealth; and that they give testimony to the beneficent law of progress from poverty.

EDWARD ATKINSON.

Boston, Feb. 7.

Youthfulness in science.

Your article upon 'Youthfulness in science' (*Science*, ix. No. 209) illustrates a most radical defect in our educational system. It does not seem to be the chief purpose to incite the student to weigh evidence and secure accurate knowledge, prizing above every thing the ability to form correct judgments in regard to the significance of observed facts. It is not even assumed that he can have any other feeling in his studies than a selfish desire for personal renown or advancement, respect for or love of truth and knowledge for their own sake being entirely out of the case. Instead of being taught to profit by criticism,

Per centum of gain in population, production, wealth, and savings, 1870 to 1885, and on some items to 1886.

To	
1885,	population..... 48
"	production of grain..... 85
"	consumption of cotton..... 86
"	consumption of wool..... 88
"	production of hay..... 100
"	deposits in savings banks of Massachusetts..... 102
"	production of cotton..... 108
1886,	deposits in savings banks of Massachusetts..... 115
1885,	production of iron..... 143
"	insurance of property against loss by fire..... 160
"	miles of railroad..... 168
1886,	miles of railroad..... 192
"	production of iron..... 200

added to the price of an able-bodied slave. The planters could not buy labor fast enough to keep up with the demand. This principle was completely stated in *DeBow's review*; and it was one of the causes which induced the extreme pro-slavery men of the south to attempt to re-open the slave-trade before the war.

Mr. Leete calls attention to the retardation in the gain of population since the war as compared to the previous period from 1850 to 1860. It does not require much thought to comprehend the reason of that retardation.

Mr. Leete asks why progress and wealth may not be predicated on the assessed value of real and personal property. I have endeavored to prove progress in the accumulation of capital without including land. People do not insure land against loss by fire, only property of other kinds. Moreover, the census figures of the past upon these points are all rubbish, as every expert of the census well knows.

It strikes me that Mr. Leete makes a good example of the common saying about statistics,—that one can twist the figures, if he chooses, so as to prove any thing that he desires to prove. No one comprehends this better than the man who is accustomed to compile statistics. The value of statistics depends wholly upon the motive with which they have been gathered, the purpose for which they have been compiled, and an exact regard to truth.

In considering these relative gains, it will be observed that they represent a constant gain in the means of subsistence over population; that, with the exception of the increase in personal wealth, which is indicated by the increase in the amount of

he is led to dread it. Moreover, he finds that his educators, instead of admitting frankly that to err is human, and that all alike must learn to profit by their mistakes, are apparently most concerned in seeking to maintain a reputation for infallibility by contributing nothing whatever to the advancement of knowledge. It is not strange that progress is slow where such a spirit prevails.

M. A. VEEDER.

Lyons, N.Y., Feb. 5.

Germ of hydrophobia.

I have not observed in your columns a reference to what appears to be an exceedingly important communication by Professor Fol, of Geneva, to the Swiss natural history society, with regard to the bacillus of rabies, which he claims to have isolated.

According to the *Biologisches centralblatt* (Dec. 51), Professor Fol finds that turpentine (even water which has been shaken up with turpentine) acts as an effective germicide when added to pure cultures of this bacillus, and that it is even more effectual than a one per cent solution of corrosive sublimate. He considers, consequently, that turpentine might be used as a substitute for the actual cautery in the treatment of recent bites, especially in places such as the face, where the cautery would produce great disfigurement. No suggestions are made as to application, but if experiments on animals should justify Professor Fol's view, it would be desirable to give it as wide publicity as possible.

R. RAMSAY WRIGHT.

Univers. coll., Toronto, Feb. 3.

SCIENCE.—SUPPLEMENT.

FRIDAY, FEBRUARY 11, 1887.

THE STUDY OF GEOGRAPHY.

It is a remarkable fact, that, in the recent literature of geography, researches on the method and limits of that science occupy a prominent place. Almost every distinguished geographer has felt the necessity of expressing his views on its aim and scope, and of defending it from being disintegrated and swallowed up by geology, botany, history, and other sciences treating on subjects similar to or identical with those of geography. If the representatives of a science as young as geography spend a great part of their time in discussions of this kind, though the material for investigations is still unlimited; if they feel compelled to defend their field of research against assaults of their fellow-workers and outsiders, — the reason for this fact must be looked for in a deep discrepancy between their fundamental views of science and those of their adversaries.

Formerly, when the greater part of the earth's surface was undiscovered, and European vessels sailed only over their well-known routes from continent to continent, careful not to stray from the old path and fearing the dangers of unknown regions, the mere thought of these vast territories which had never been sighted by a European could fill the mind of geographers with ardent longing for extended knowledge; with the desire of unveiling the secrets of regions enlivened by imagination with figures of unknown animals and peoples. But the more completely the outlines of continents and islands became known, the stronger grew the desire to *understand* the phenomena of the newly discovered regions by comparing them with those of one's own country. Instead of merely extending their study over new areas, scientists began to be absorbed in examining the phenomena more intently, and comparing them with the results of observations already made. Thus Humboldt's admirable works and Karl Ritter's comparative geography arose out of the rapidly extending knowledge of the earth.

The fact that the rapid disclosure of the most remote parts of the globe coincided with the not less rapid development of physical sciences has had great influence upon the development of geography; for while the circle of phenomena became wider every day, the idea became prevalent that a single phenomenon is not of great avail,

but that it is the aim of science to deduce laws from phenomena; and the wider their scope, the more valuable they are considered. The descriptive sciences were deemed inferior in value to researches which had hitherto been outside their range. Instead of systematical botany and zoölogy, biology became the favorite study; theoretical philosophy was supplanted by experimental psychology; and, by the same process, geography was disintegrated into geology, meteorology, etc.

Ever since, these sciences have been rapidly developed, but geography itself has for a long time been almost overshadowed by its growing children. However, we do not think they can fill its place, and wish to prove that its neglect cannot be remedied by the attentive cultivation of those sciences separately.

Those accustomed to value a study according to the scope of the laws found by means of it are not content with researches on phenomena such as are the object of geography. They consider them from a physical stand-point, and find them to be physical, meteorological, or ethnological; and, after having explained them by means of physical, physiological, or psychological laws, have finished their work. It is very instructive to consider thoroughly their definition of geography. They declare that the domain of this science comprises neither magnetical and meteorological nor geological phenomena and processes. They generously grant it the study of the distribution of animals and plants, as far as physiologists and evolutionists will permit; but all agree that anthropo-geography — the life of man as far as it depends on the country he lives in — is the true domain of geography.

It is not difficult to discover the principle on which this segregation is founded. Physical phenomena are subject to physical laws which are known, or which will assuredly be found by the methods used in discovering those that are known. Physiological, and, to a still higher degree, psychological, laws are not so well known as to allow their being treated in the same way as physical laws. The conditions of the phenomena are generally so complicated, that, even if the most general laws were known, a strict conclusion cannot easily be drawn. But were those auxiliary sciences just as far developed as physics, no doubt the same scientists who at the present time concede them willingly to geography would not hesitate to claim them for physiology and psychology. It

is evident that there is no middle way: geography must either be maintained in its full extent or it must be given up altogether.

As soon as we agree that the purpose of every science is accomplished when the laws which govern its phenomena are discovered, we must admit that the subject of geography is distributed among a great number of sciences; if, however, we would maintain its independence, we must prove that there exists another object for science besides the deduction of laws from phenomena. And it is our opinion that there *is* another object, — the thorough understanding of phenomena. Thus we find that the contest between geographers and their adversaries is identical with the old controversy between historical and physical methods. One party claims that the ideal aim of science ought to be the discovery of general laws; the other maintains that it is the investigation of phenomena themselves.

It is easily understood, therefore, why in geography the contest between these views is particularly lively. Here naturalists and historians meet in a common field of work. A great number of modern geographers have been educated as historians, and they must try to come to an agreement with the naturalists, who, in turn, must learn to accommodate their views to those of the historians. It is evident that an answer to this fundamental question on the value of historical and physical science can only be found by a methodical investigation of their relation to each other.

All agree that the establishment of facts is the foundation and starting-point of science. The physicist compares a series of similar facts, from which he isolates the general phenomenon which is common to all of them. Henceforth the single facts become less important to him, as he lays stress on the general law alone. On the other hand, the facts are the object which is of importance and interest to the historian. An example will explain our meaning more satisfactorily than a theoretical discussion.

When Newton studied the motion of the planets, the distribution of those celestial bodies in space and time were the means, not the object, of his researches. His problem was the action of two bodies upon each other, and thus he found the law of gravitation. On the other hand, Kant and Laplace, in studying the solar system, asked the question, Why is every one of the bodies constituting the solar system in the place it occupies? They took the law as granted, and applied it to the phenomena from which it had been deduced, in order to study the history of the solar system. Newton's work was at an end as soon as he had

found the law of gravitation, which law was the preliminary condition of Kant's work.

Here is another example: according to Buckle's conception, historical facts must be considered as being caused by physiological and psychological laws. Accordingly, he does not describe men and their actions as arising from their own character and the events influencing their life, but calls our attention to the laws governing the history of mankind. The object of the historians is a different one. They are absorbed in the study of the facts, and dwell admiringly on the character of their heroes. They take the most lively interest in the persons and nations they treat of, but are unwilling to consider them as subject to stringent laws.

We believe that the physical conception is nowhere else expressed as clearly as in Comte's system of sciences. Setting aside astronomy, which has been placed rather arbitrarily between mathematics and physics, all his sciences have the one aim, to deduce laws from phenomena. The single phenomenon itself is insignificant: it is only valuable because it is an emanation of a law, and serves to find new laws or to corroborate old ones. To this system of sciences Humboldt's '*Cosmos*' is opposed in its principle. Cosmography, as we may call this science, considers every phenomenon as worthy of being studied for its own sake. Its mere existence entitles it to a full share of our attention; and the knowledge of its existence and evolution in space and time fully satisfies the student, without regard to the laws which it corroborates or which may be deduced from it.

Physicists will acknowledge that the study of the history of many phenomena is a work of scientific value. Nobody doubts the importance of Kant's researches on the solar system; nobody derogates from that of investigations upon the evolution of organisms. However, there is another class of phenomena the study of which is not considered of equal value, and among them are the geographical ones. In considering the geography of a country, it seems that the geological, meteorological, and anthropo-geographical phenomena form an incidental conglomerate, having no natural tie or relation to one another, while, for instance, the evolutionist's subject of study forms a natural unity. We may be allowed to say that the naturalist demands an objective connection between the phenomena he studies, which the geographical phenomena seem to lack. Their connection seems to be subjective, originating in the mind of the observer.

Accordingly there are two principal questions which must be answered: first, the one referring to the opposition between physicists and cosmog-

raphers, i.e., Is the study of phenomena for their own sake equal in value to the deduction of laws? second, Is the study of a series of phenomena having a merely subjective connection equal in value to researches on the history of those forming an objective unity?

We shall first treat on the difference of opinion between physicists and cosmographers. The two parties are strongly opposed to each other; and it is a hard task to value justly the arguments of opponents whose method of thinking and way of feeling are entirely opposed to one's own. An unbiassed judgment cannot be formed without severe mental struggles which destroy convictions that were considered immovable, and had become dear to us. But those struggles lead to the grander conviction that both parties, though in a permanent state of conflict, aspire to the same end, — to find the eternal truth.

The origin of every science we find in two different desires of the human mind, — its aesthetic wants, and the feelings, which are the sources of the two branches of science. It was an early desire of developing mankind to arrange systematically the phenomena seen by the observer in overwhelming number, and thus to put the confused impressions in order. This desire must be considered an emanation of the aesthetical disposition, which is offended by confusion and want of clearness. When occupied in satisfying this desire, the regularity of the processes and phenomena would attain a far greater importance than the single phenomenon, which is only considered important as being a specimen of the class to which it belongs. The clearer all the phenomena are arranged, the better will the aesthetic desire be satisfied, and, for that reason, the most general laws and ideas are considered the most valuable results of science.

From this point of view, the philosophical ideas of Epicurus are very interesting, as they may be considered the extreme opinion to which this aesthetical desire can lead if the pleasure one enjoys in arranging phenomena in a clear system is the only incentive. He considered any explanation of a phenomenon sufficient, provided it be natural. It does not matter, he taught, if an hypothesis is true, but all probable explanations are of the same value, and the choice between them is quite insignificant. We believe this opinion is called to a new life by a number of modern scientists, i.e., by those who try to construct the evolution of organisms in details which, at the present time at least, can neither be proved nor refuted. If, for instance, Müller describes the history of the evolution of flowers, he gives only a probable way of development, without any better proof than that

it seems to be the simplest and therefore the most probable. But this construction of a probable hypothesis as to the origin of these phenomena gives a satisfaction to our aesthetical desire to bring the confusion of forms and species into a system. But it should be borne in mind that a theory must be true, and that its truth is the standard by which its value is measured. Therefore naturalists are always engaged in examining the truth of their theories by applying them to new phenomena, and in these researches those phenomena are the most important which seem to be opposed to the theories. As soon as the question whether the theory is applicable to the class of phenomena is solved, the whole class is of little further interest to the investigator.

While physical science arises from the logical and aesthetical demands of the human mind, cosmography has its source in the personal feeling of man towards the world, towards the phenomena surrounding him. We may call this an 'affective' impulse, in contrast to the aesthetic impulse. Goethe has expressed this idea with admirable clearness: "It seems to me that every phenomenon, every fact, itself is the really interesting object. Whoever explains it, or connects it with other events, usually only amuses himself or makes sport of us, as, for instance, the naturalist or historian. But a single action or event is interesting, not because it is explainable, but because it is true" (*Unterhaltungen deutscher Ausgewanderten*).

The mere occurrence of an event claims the full attention of our mind, because we are affected by it, and it is studied without any regard to its place in a system. This continuous impulse is the important counterbalance against the one-sidedness of a science arisen from merely aesthetic impulses. As the truth of every phenomenon causes us to study it, a true history of its evolution alone can satisfy the investigator's mind, and it is for this reason that Epicurus's probable or possible explanation is not at all satisfactory for science, but that every approach to truth is considered a progress by far superior to the most elaborate system which may give proof of a subtle mind and scrupulous thought, but claims to be only one among many possible systems.

Naturalists will not deny the importance of every phenomenon, but do not consider it worthy of study for its own sake. It is only a proof or a refutation of their laws, systems, and hypotheses (as they are deduced from true phenomena), which they feel obliged to bring as near the truth as possible. The deductions, however, are their main interest; and the reward of the indefatigable student is to review, from the summit of his most general deductions, the vast field of phenomena.

Joyfully he sees that every process and every phenomenon which seem to the stranger an irregular and incomprehensible conglomerate is a link of a long chain. Losing sight of the single facts, he sees only the beautiful order of the world.

The cosmographer, on the other hand, holds to the phenomenon which is the object of his study, may it occupy a high or a low rank in the system of physical sciences, and lovingly tries to penetrate into its secrets until every feature is plain and clear. This occupation with the object of his affection affords him a delight not inferior to that which the physicist enjoys in his systematical arrangement of the world.

Our inquiry leads us to the conclusion that it is in vain to search for an answer to the question, Which of the two methods is of a higher value? as each originates in a different desire of the human mind. An answer can only be subjective, being a confession of the answerer as to which is dearer to him, — his personal feeling towards the phenomena surrounding him, or his inclination for abstractions; whether he prefers to recognize the individuality in the totality, or the totality in the individuality.

Let us now turn to the discussion of the second point. We have seen that physicists are inclined to acknowledge the value of a certain class of cosmographical studies. It is the characteristic quality of those phenomena that they are the result of the action of incidental causes upon one group of forces, or upon the elements of phenomena. The physicist does not study the whole phenomenon as it represents itself to the human mind, but resolves it into its elements, which he investigates separately. The investigation of the history of these elements of phenomena leads to a systematical arrangement, which gives to the aesthetical desire as much satisfaction as the formulation of laws. The end which evolutionary and astronomical researches tend to is the best proof of this fact. A study of groups of phenomena, which seem to be connected only in the mind of the observer, and admit of being resolved into their elements, cannot lead to a similar result, and is therefore considered of inferior value. However, we have tried to prove that the source of cosmographical researches is an affective one. If this be right, we cannot distinguish between complex and simple phenomena, as the physicist tries to do, and neglect their subjective unity, — the connection in which they appear to the mind of the observer. The whole phenomenon, and not its elements, is the object of the cosmographer's study. Thus the physiognomy of a country is of no interest to the physicist, while it is important to the cosmographer.

From the stand-point we occupy, a discussion as to the value of these researches is of just as little avail as that on the value of the two branches of science, for the judgment will be founded on the mental disposition of the judge, and be only a confession as to which impulse predominates, the aesthetic or the affective. However, one fact appears from our inquiry: cosmography is closely related to the arts, as the way in which the mind is affected by phenomena forms an important branch of the study. It therefore requires a different treatment from that of the physical sciences.

We will apply these results to the study of geography. Its objects are, the phenomena caused by the distribution of land and water, by the vertical forms of the earth's surface, and by the mutual influence of the earth and its inhabitants upon each other.

What does the physicist do with this object of study? He selects a single element out of phenomena which are observed at a certain point of the earth's surface, and compares it with another one found at another place. He continues in this way searching for similar phenomena, and loses sight altogether of the spot from which he started. Thus he becomes the founder of the sciences into which geography has gradually been resolved, as his studies are either directed to geological phenomena alone, or to meteorological, botanical, or whatever it may be. The most general deductions which can be reached in the pursuit of these studies still have a close connection with the single object, as they cannot be carried farther than to the most general geographical ideas, as mountain-ranges, running water, oceans, etc. The most general results of his investigations will therefore be a general history of the earth's surface. If he bring these results into a system, he acts, as it seems to us, against the cosmographical character of the science. For instance, a system of all possible actions of water as forming the earth's surface seems to us of little value, except from a practical stand-point as being useful in studying the geological history of a district or of the earth's surface. Therefore these systems must be considered as important auxiliary sciences, but they are not geography itself. Their value is founded only on their applicability to the study of geography. The invention of geographical systems, so far as they do not serve this purpose, must be considered as useless, and classifications must be made only as far as geographical phenomena of a similar kind must be explained by different causes.

But there is another branch of geography besides this, equal to it in value, — the physiognomy of the earth. It cannot afford a satisfactory ob-

ject of study to the physicist, as its unity is a merely subjective one; and the geographer, in treating these subjects, approaches the domain of art, as the results of his study principally affect the feeling, and therefore must be described in an artistic way in order to satisfy the feeling in which it originated.

Our consideration leads us to the conclusion that geography is part of cosmography, and has its source in the affective impulse, in the desire to understand the phenomena and history of a country or of the whole earth, the home of mankind. It depends upon the inclination of the scientist towards physical or cosmographical method, whether he studies the history of the whole earth, or whether he prefers to learn that of a single country. From our point of view, the discussion whether geology or meteorology belongs to geography is of little importance, and we are willing to call all scientists geographers who study the phenomena of the earth's surface. We give geology no preference over the other branches of science, as many modern scientists are inclined to do. The study of the earth's surface implies geological researches as well as meteorological, ethnological, and others, as none of them cover the scope of geography, to delineate the picture of the earth's surface.

Many are the sciences that must help to reach this end; many are the studies and researches that must be pursued to add new figures to the incomplete picture; but every step that brings us nearer the end gives ampler satisfaction to the impulse which induces us to devote our time and work to this study, gratifying the love for the country we inhabit, and the nature that surrounds us.

FRANZ BOAS.

ITALIAN MEDICAL PSYCHOLOGY.

THE study of the nervous system in health and disease has been assiduously cultivated in Italy for many years. The peculiar environment and volatile characteristics of the race may have been influential in drawing attention to the study of insanity.

Italian alienists have taken a deep interest in the psychological aspects of their specialty; and their main review, the *Rivista sperimentale di freniatria*, has been thriving for many years. A brief notice of a few of the articles contained in the last volume will serve to indicate some of the directions in which work is being carried on.

A frequent contributor to this review was the physiologist Buccola, who died last year. He has published a volume in the International scientific series which is devoted to an account of the ex-

perimental study of the time of psychic processes, and which merits an English translation. One of his latest researches is embodied in a long article in this review on the electric reaction of the acoustic nerve in the insane. If you place one of the poles in the external auditory chamber, and the other on the neck or the hand, besides causing slight pain, muscular contractions, etc., a distinct sound will be heard on closing the circuit if the negative pole is in contact with the ear, and on opening the circuit if it is the positive pole. This for the healthy ear. But in the insane this formula is sometimes reversed, and suffers irregularities. The examination of the auditory apparatus is thus of diagnostic value, especially in cases of auditory hallucinations. In almost all such cases the hearing is thus shown to be diseased, and in a few cases stimulation of the auditory nerve caused the hallucinations to appear.

Two observers, Tambroni and Algeri, contribute to this study of the psychic diagnosis of insanity an account of experiments upon the reaction times of the insane. After some preliminary training, the patient was subjected to eight tests of forty observations each. An observation consisted, 1°, in measuring the time necessary for the patient to feel the contact of a point; 2°, the time to perceive whether a single point or a pair of points 2.2mm. apart was drawn across the tip of his right forefinger. The paranoic patient reacts more quickly than the normal man; and in this is implied not only that he feels sooner, but knows what he feels more rapidly: it is a psychic hyperaesthesia. In all other forms of insanity the time of a simple reaction and of a distinction is lengthened when the normal time is .183 of a second; the time of the paranoic type is .174 of a second; of the maniacal, .312; of the demented, .344; of the epileptic, .362; of the melancholic (in whom all mental life is sluggish and monotonous), .374. Four persons of each type were examined. It takes slightly longer to perceive a double than a single point.

A very careful study on the effect of repetition of simple acts, that is, of practice, upon the time it takes to perform them, is rendered by Guicciardi and Cionini. They take as their basis three well-known laws regarding practice; viz., 1°, that it makes repetition easier (and quicker); 2°, that it does so at first more rapidly than later on; and, 3°, that a limit to this process is slowly reached. The original part of their work consists in showing that practice has greater abbreviating power in complicated than in simple acts. A simple touch reaction by the effect of 250 repetitions was shortened .018 of a second; the time for perceiving that but a single point was touching

the skin, by .121 of a second; that two points were touching, by .194 of a second. The time necessary for uniting three letters was shortened by 1.956 seconds in 500 repetitions. In associating abstract words, there was a difference of nearly five seconds between the longest and the shortest time.¹

MINERAL PHYSIOLOGY AND PHYSIOGRAPHY.

THIS book is a collection of essays which their author has published during the past few years in the proceedings of several learned societies, especially in the Transactions of the Royal Society of Canada. The preface states that they were all written with a predetermined plan, which their presentation in this connected form for the first time fully realizes. The work will furnish a valuable addition to every geological library. There is apparent in it an astonishing amount of learning and painstaking research, in spite of the fact that the views of others are not infrequently presented in a partial or one-sided manner; the author's conclusions also are well worthy of study, although many of them will hardly be received by geologists as final.

It would be impossible, in a brief review, to do justice to a single one of the essays, to say nothing of the collection of them before us. The first two serve as a general introduction and attempt to show the relations of the natural sciences to each other and to geology. Then are considered in succession the chemistry of the earth's atmosphere; the origin and decay of the crystalline rocks; a natural system in mineralogy; a history of pre-Cambrian rocks and serpentines; and, finally, the Taconic question.

The most interesting and novel portion of the work is contained in chapters v. and vi., which set forth the author's remarkable views regarding the origin of the crystalline schists. These, as he states, are purely Neptunic or Wernerian. The former hypotheses relating to the Archean rocks are reviewed and classified as, 1°, endoplutonic; 2°, exoplutonic; 3°, metamorphic; 4°, metasomatic; 5°, chaotic; 6°, thermochaotic. None of these are regarded as satisfactory; and a seventh, so-called 'crenitic' theory is therefore advanced. According to this, the globe has solidified regularly from its centre outward, its last layer being a basic, quartzless rock, not unlike dolerite in composition. This mass was fissured and ren-

dered porous by 'refrigeration and crystallization' (!) and upon it were precipitated the waters, till then held in the atmosphere. These were set in circulation by the heat from below, and under high temperature and pressure they leached out the more acid, alkaline silicates from the basic substratum below, and deposited them in thick layers at the surface, like the products of thermal springs (hence the term 'crenitic,' from κρήνη, 'a fountain'). The chemistry of this process is supposed to resemble that whereby quartz, orthoclase, and the zeolitic minerals are occasionally deposited in cavities of basic eruptive rocks. By such crenitic action, in the author's opinion, all the banded, pre-Cambrian rocks were formed. These were, moreover, of such a thickness as to bury the original basic substratum too deeply for any subsequent upheavals to expose it at the earth's surface. The crenitic hypothesis is also supposed to offer "for the first time a reasonable and tenable explanation of the universal corrugation of the oldest crystalline strata," in the removal of such a large quantity of matter from the underlying basic layer. Through these crumpled crenitic rocks (Archean granites, gneisses, and schists) came intrusions of a basic magma derived from the underlying or original stratum, while the upper or transition pre-Cambrian rocks, as the author calls them with Werner, are regarded as derived from the subaerial decay of the two types of primary origin.

The objections which at once suggest themselves to this remarkable theory of the origin of the crystalline rocks are far too many to be even mentioned here. The leaching-out of a layer, 'at least many miles in thickness,' of quartz and potash-felspar, from a basic substratum, requires sufficient draughts on the imagination; while, even in case this be assumed as possible, it is still more difficult to conceive how the waters could circulate through this compact overlying layer which they were depositing, with sufficient freedom to increase it to anywhere near the thickness which the hypothesis requires.

No one will deny that any single one of the numerous theories hitherto proposed, fails to satisfactorily account for all the phenomena exhibited by the so-called crystalline rocks; nor is it at all probable that any theory ever will accomplish this. There is doubtless some element of truth in all the theories, and the only way to explain the diversity of Archean geology would seem to be by the assumption of an equal diversity in the causes which produced it. The dogma that many different agencies may not have acted at the same time in the formation of the pre-Cambrian rocks, is as dangerous as the other, that the same agency may

¹ It is not quite clear whether these differences refer to the extreme limits of a single experiment, or to the extreme differences of the average of each set of fifty observations.

Mineral physiology and physiography. By T. STERRY HUNT. Boston, Cassino. 8°.

not have acted at different times, — one that carries with it the fallacious conclusion that the lithological character of a rock is any reliable indication of its geological age.

Chapter viii., entitled 'A natural system in mineralogy,' suggests a new basis of mineralogical classification, and illustrates it in a new classification of the silicates. These are divided into three main groups, according as their bases are in the protoxide state (protosilicates), in both the protoxide and sesquioxide states (protopersilicates), or wholly in the sesquioxide state (persilicates). These groups are further divided into various tribes according to principles which cannot be explained in this place. Whatever may be the chemical merits of this system, it would appear to do serious violence to the crystallographic relationships of certain minerals, as may be seen in the wide separation of the members of the pyroxene and amphibole groups.

The three remaining essays are of an historical character, and contain a vast amount of information regarding the views which have been held on the subject of crystalline rocks. The first of these is a summary of the writer's report E of the Second geological survey of Pennsylvania, on the pre-Cambrian rocks in America and Europe. The second deals with the geological history of the serpentines, and develops the writer's idea that all serpentines are of aqueous origin, being of the nature of chemical precipitates. The chemical origin of a small and long-since buried bed of a serpentine-like deposit occurring in the Onondaga salt-group at Syracuse, N.Y., and of the magnesian silicates (sepiolites) of the Paris basin, together with certain reactions which are found to take place between the carbonates of lime and magnesia and free silica in heated solutions, are adduced as a proof that *all* serpentine is of chemical origin. There seems here to be a very partial and one-sided statement of the best authorities on this subject, for the origin of serpentine by the hydration of eruptive chrysolitic rocks will surely be disputed to-day by no one who has carefully and impartially looked into the matter. Though there may be truth in both hypotheses, there is more evidence in favor of the latter; so that here, again, the danger of accounting for all rocks of similar character by one set of causes becomes apparent.

The final essay is devoted to an elaborate review of the Taconic question and a statement of the writer's opinion that the Taconic of Emmons is a formation of the transition class, which unconformably underlies the Cambrian, and is separated from it by a great interval of time which includes the Keweenaw period.

Throughout, the book is interesting, — almost fascinating, — but nevertheless full of danger to any one who accepts it implicitly as a guide, or to the beginner who is not able to estimate it in comparison with the work of others.

REMSEN'S ELEMENTS OF CHEMISTRY.

IN the preface to his 'Elements of chemistry,' Professor Remsen states his opinion, that if a course in chemistry "does not to some extent help the pupil to think as well as to see, to reason as well as to observe, it does not deserve to be called rational." An essential part of his plan in this elementary course is the performance of experiments by the pupil, who is then to be questioned by the teacher concerning the results of the experiments, and the conclusions to be drawn from them. Appropriate questions are given in the book in connection with the description of each experiment, and a quite extensive list of questions and problems (not numerical) is appended at the end of the work. A number of experiments, with questions, illustrative of chemical change in general, are given at the outset, before even the names of the elements, or the distinction between elements and compounds, is imparted. The atomic theory and that of valence are treated briefly and clearly, special care being taken to prevent the too common confusion of facts and hypotheses in the young student's mind. A great deal of attention is devoted to subjects which are likely to interest the pupil by reason of their practical importance or their relation to his daily life. Such are the manufacture of soap and paper, fermentation, bread-making, the working of iron, and the impurities of water. In these as well as in other subjects the endeavor seems to have been made to introduce all of the most recent discoveries and advances which are suitable to an elementary treatise. Examples are the water-gas process, the liquefaction of the 'permanent' gases, the electrical furnace, celluloid, cocaine, and artificial alizarin.

About one-ninth of the volume is devoted to a description of some of the compounds of carbon. The relations between the principal classes of these bodies are pointed out, but no attempt is made to teach the structural formulae of the more complex compounds.

THE U.S. consul at Palermo, Mr. Philip Carroll, has forwarded to the state department a translation of a pamphlet issued by Prof. E. Albanese, president of the sanitary council of

The elements of chemistry. By IRA REMSEN. New York, Holt. 12°.

Palermo. In this pamphlet he says that typhoid and scarlet fevers, diphtheria, small-pox, and cholera seem to have made their abode in Italy. The country remains unprovided with sanitary laws; and the government, lacking etiological and hygienic knowledge, makes provision only when any disease appears, and nearly always in consonance with the impression of the moment, issuing confusing or conflicting decrees and unreasonable instructions, which are nearly always useless. Then the cholera has its sway, and cities are terror-stricken. The sanitary authorities of the kingdom, the superior sanitary council, the minister of the interior, prefects and mayors, frequently provide contradictory measures, issuing regulations of no efficacy in preventing the spread of infectious diseases. During the last twenty-six years, in which Italy has been free, the government has never occupied itself with public health. In Sicily, Napoletano, Puglie, and Abruzzo, animals dwell in the same rooms with the people who own them. The pamphlet of Professor Albanese clearly demonstrates that sanitary matters in Italy are about as bad as they can be, and that, unless remedies are soon applied, there is nothing in the list of epidemic diseases which may not be looked for in the near future. He recommends that the government should at once assemble a commission composed of the most eminent hygienists and practical physicians, with a view to projecting a re-organization of sanitary systems.

— No. v. of part iv. of the eleventh volume of the 'Memoirs of the American academy of arts and sciences' contains the first instalment of a 'catalogue of 130 polar stars for the epoch 1875.0.' The joint authors are Prof. William A. Rogers and Miss Anna Winlock; and to the latter the credit of the execution of the work, according to Professor Rogers's plans, is due. The computations involved are very laborious, and one must admire the zeal and patience with which Miss Winlock has carried them through. The catalogue is based upon all observations of the stars from 1860 to 1885, and therefore a large number of reductions to the epoch 1875.0 had to be performed. For polar stars these reductions are quite tedious, because terms of higher orders cannot be neglected. It was therefore decided to discuss the various methods of reduction, and to find out the limitations of the approximations employed. The star Groombridge 1119 was chosen for this purpose, it being one degree from the pole, and the computations are given *in extenso*. The conclusions reached as to the availability of the different methods cannot be explained here, but are of much interest to astronomers. The authors have

made a really valuable contribution to the literature of the subject. Among other things, the catalogue, when completed, will contain yearly ephemerides of all of its stars within three degrees of the pole, and data for the reduction of the different catalogues employed to the system of the *Astronomische Gesellschaft*.

— Dr Lombard has re-investigated the question as to whether or not the upward movement of the leg, when the patellar tendon under the knee is struck, is a reflex act. The main argument against its being so is that the act requires only .03 to .04 of a second, while the reflex act requires .11. The chief point in favor of its reflex origin is that the vigor of the reaction depends on the integrity and health of the spinal cord. The explanation that the phenomenon is direct muscle-effect, but that the spinal cord must send down a shower of reflexes or keep up a healthy tonus to have the act result, is very unsatisfactory. Dr. Lombard found that the act follows after the same interval, when the muscle is electrically stimulated or the tendon struck, but that the interval is much longer (four times as long) when a reflex contraction is excited by rubbing the skin. Hence it is argued that the phenomenon is a direct muscular stimulation, and occurs too quickly to be of a reflex nature. In one case an after-jerk, following at an interval that suggested a reflex origin, was recorded; but this compound nature of the response, though carefully looked for, was not again observed. The explanation of the relation of the knee-jerk to the spinal cord cannot yet be given.

— George Fleming, LL.D., principal veterinary surgeon of the British army, regards as untrue the generally accepted theory that small-pox in man, and cow-pox, are one and the same disease. One of the best authorities quoted in support of the theory was the late Mr. Ceely, who reported that he had succeeded in producing cow-pox by inoculating a cow with small-pox matter. Dr. Fleming believes that Mr. Ceely was misled in this experiment, and that what he really used was vaccine, and not the virus of small-pox. His experiment was subsequently repeated on twelve heifers by Dr. Klein under Mr. Ceely's supervision, and, though small-pox matter was inserted abundantly into the incisions, cow-pox was not developed in any of the animals. Similar experiments have been performed in France and Italy, and the results have all been the same as those in England. Dr. Fleming holds that all these experiments go to show that the two diseases are not identical, nor can cow-pox be produced by inoculation with small-pox virus.